

Pushes, pulls and balanced forces

Grade 7 science (Year 8 · Class 7) · Lab answers

These model answers use the sample table. Your own readings will differ, but the ranking of the surfaces should be the same and doubling the load should roughly double the friction.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS2-1, MS-PS2-2

Question 1 Variables

1. The **type of surface** and the **load on the block**.
2. The **force read on the scale** (the friction force).
3. The pulling speed (steady and slow), or the contact area of the block.

Question 2 Why steady speed?

At a steady speed the net force is zero, so the pull and the friction are balanced and equal. If the block speeds up, the pull is bigger than friction and the reading would be **too high**.

Question 3 Ranking surfaces

Plastic (1.2 N), wood (2.0 N), carpet (2.8 N), sandpaper (3.3 N). The ranking from least to most friction is **plastic, wood, carpet, sandpaper**.

Question 4 Effect of load

Ratio for sandpaper = $6.5 \div 3.3 = \mathbf{1.97}$, about 2. For every surface, doubling the load roughly **doubles the friction**.

Question 5 Friction compared with weight

0.50 kg: $2.0 \div 4.9 = \mathbf{0.41}$. 1.00 kg: $4.1 \div 9.8 = \mathbf{0.42}$.

The ratio is almost the same, so friction is proportional to the pressing force for a given surface.

Question 6 Prediction

1.5 kg is three times 0.50 kg, so friction $\approx 3 \times 1.2 = \mathbf{3.6\ N}$.

Question 7 Uncertainty

$0.1 \div 1.2 \times 100 = 8 \%$ (7.8 % unrounded).

The small readings have the largest percentage uncertainty, so differences between close values should be treated with care.

Question 8 Better friction measurements

Use a scale with finer divisions, check its zero before every reading and repeat more times.

A motor-driven runner would keep the pulling speed the same each time.